AMENDMENTS TO THE CLAIMS

Claim 1 (Presently Amended): A method for determining temperature of a transducer of an ultrasonic hand piece~~;~~, comprising the steps of:

determining a shunt capacitance of the transducer;

calculating the temperature of the transducer based on the shunt capacitance of the transducer; and

providing a warning to a user of the hand piece if one of the temperature of the transducer and a rate of change of the temperature is excessive.

Claim 2 (Original): The method of claim 1, wherein said determining step comprising the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring shunt capacitances of the transducer at frequencies across the predefined frequency range;

comparing the measured shunt capacitances;

determining whether any measured shunt capacitance varies by more than a predetermined value for all measured shunt capacitances; and

averaging the measured shunt capacitances and calculating the transducer temperature.

Claim 3 (Original): The method of claim 2, further comprising the step of:

filtering the measured shunt capacitances.

Claim 4 (Original): The method of claim 3, wherein said filtering comprises the steps of:

discarding invalid measured shunt capacitance values which vary by greater than the predetermined value; and

determining whether a number of remaining measured shunt capacitance values is greater than a pre-defined number; and

returning to the step of measuring shunt capacitances of the transducer, if the number of remaining measured shunt capacitance values is less than the pre-defined number.

Claim 5 (Original): The method of claim 4, wherein the pre-defined number is 3.

Claim 6 (Original): The method of claim 2, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

Claim 7 (Original): The method of claim 2, wherein the pre-defined frequency range is set such that non-resonant frequencies are located in the predefined frequency range.

Claim 8 (Original): The method of claim 2, wherein said measuring step comprises the step of:

measuring shunt capacitances at several different frequencies within and spaced along the predefined frequency range.

Claim 9 (Original): The method of claim 8, wherein the shunt capacitances are measured at five different frequencies.

Claim 10 (Original): The method of claim 2, wherein the pre-determined value is approximately 10 percent.

Claim 11 (Original): The method of claim 2, wherein the calculation is performed in accordance with the relationship:

$$\Delta C_o = C_s - C_o ,$$

where C_s is the capacitance at an off-resonance frequency which is stored in memory and C_o is the shunt capacitance.

Claim 12 (Presently Amended): The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring the hand piece impedance;

determining whether ~~the hand piece~~a phase difference between the voltage and current of the hand piece is less than a predetermined value;

measuring the hand piece impedance a pre-established number of times;

computing a hand piece average shunt capacitance;

incrementing the drive signal by a set frequency value;

determining whether ~~one of~~ the drive frequency is greater than a pre-set frequency ~~and~~ or whether a number of impedance measurements is ~~less~~ greater than a pre-defined number; and

if the result of the determining step is positive, computing an average shunt capacitance value at each drive frequency.

Claim 13 (Original): The method of claim 12, further comprising the step of:

incrementing the drive signal by the set frequency value, if the absolute value of the hand piece phase difference is greater than the predetermined value; and

returning to the step of measuring the hand piece impedance.

Claim 14 (Original): The method of claim 13, wherein the set frequency value is 25 Hz and the predetermined value is 89.5°.

Claim 15 (Original): The method of claim 12, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

Claim 16 (Original): The method of claim 12, further comprising the step of:

performing a calculation to determine whether the hand piece is within acceptable temperature limits; and

providing a warning, if the transducer temperature is not within acceptable limits.

Claim 17 (Original): The method of claim 16, wherein the calculation is performed in accordance with the relationship:

$$\Delta C_o = C_s - C_o,$$

where C_s is the capacitance at an off-resonance frequency which is stored in memory and C_o is the shunt capacitance.

Claim 18 (Original): The method of claim 12, wherein the pre-established number is 10 percent.

Claim 19 (Original): The method of claim 12, wherein the average shunt capacitance is computed in accordance with the relationship:

$$C_o = \frac{1}{2\pi f |Z_{HP}|},$$

where f is the drive frequency of the generator, and Z_{HP} is the hand piece impedance.

Claim 20 (Original): The method of claim 12, wherein the pre-set frequency is 44.5 kHz and the pre-defined number is 100.

Claim 21 (Withdrawn): The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the hand piece/blade across a pre-defined frequency range;

measuring a first hand piece shunt capacitance when a user first activates the hand piece/blade;

measuring a second hand piece/blade shunt capacitance when the surgeon deactivates the hand piece/blade;

calculating a time difference between when the hand piece/blade is activated and deactivated using a time when the first measured hand piece/blade shunt capacitance is obtained and a time when the second measured hand piece/blade shunt capacitance is obtained;

computing a rate of change value of the hand piece/blade shunt capacitance using the calculated time difference;

determining whether the rate of change value of the hand piece/blade shunt capacitance is greater than a predetermined threshold above a value stored in memory; and

providing a warning to the user, if the rate of change value of the hand piece/blade shunt capacitance is greater than the predetermined threshold above the value stored in memory.

Claim 22 (Withdrawn): The method of claim 21, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

Claim 23 (Withdrawn): The method of claim 21, wherein said computing step comprises the step of:

dividing a difference between the first measured hand piece/blade shunt capacitance and the second measured hand piece/blade shunt capacitance by a difference in time between when

the first measured hand piece/blade shunt capacitance is obtained and when the second measured hand piece/blade shunt capacitance is obtained.

Claim 24 (Withdrawn): The method of claim 21, wherein the predetermined threshold is a shunt capacitance rate of change value stored in memory.

Claim 25 (Withdrawn): The method of claim 24, wherein the predetermined threshold is 120 pF/min.

Claim 26 (Original): The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring the hand piece impedance at fixed frequency intervals to obtain a measured impedance at each frequency interval;

performing a curve fit based on each measured impedance at each frequency interval to obtain a curve fit equation;

solving the curve fit equation at equally spaced frequency values to obtain a group of distinct impedance values;

calculating a shunt capacitance based on each distinct impedance value;

discarding a maximum and a minimum calculated shunt capacitance value to obtain a residual group of shunt capacitances; and

averaging the residual group of shunt capacitances to obtain a final shunt capacitance value of the hand piece.

Claim 27 (Original): The method of claim 26, wherein the curve fit is performed in accordance with the relationship:

$$Z_{HP} = af_o^2 + bf_o + c,$$

where a, b and c are constants which are calculated via the curve fit and f_o is a fixed frequency at which the hand piece impedance is measured.

Claim 28 (Original): The method of claim 22, wherein the pre-defined frequency range is from approximately 34.5 kHz to 44.5 kHz.

Claim 29 (Original): The method of claim 26, wherein the fixed frequency interval is 50 Hz.

Claim 30 (Original): The method of claim 26, wherein the shunt capacitance is calculated in accordance with the relationship:

$$C_o = -\left(1/f_o\right) * \left(Z_{HP}^2 - 1/R_p^2\right)^{1/2} - (C_{v1} * C_{v2})/(C_{v1} + C_{v2}) + 1/\left(f_o^2 * L_t\right) - C_c - C_{pcb},$$

where C_o is the shunt capacitance, f_0 is a fixed frequency at which the hand piece impedance is measured, Z_{HP} is the hand piece impedance at the fixed frequency f_0, R_p is a value of a limiting resistor, C_{v1} and C_{v2} are values of voltage dividing capacitors, L_t is a value stored in memory of the

generator which represents a transducer tuning inductor, C_c is a capacitance of a hand piece cable and C_{pcb} is a contribution of capacitance from a printed circuit board in the generator.

Claim 31 (Original): The method of claim 26, wherein the group of distinct impedance values comprises eleven impedance values.

Claim 32 (Original): The method of claim 26, wherein the equally spaced frequency values are spaced apart at 1000 Hz intervals.